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REPORT
OF
P. Florent
CHARLES BAILLAIRGE
(1827-1906)
Engineer of the City of Quebec.

ON THE
10 MILE SECTION
OF THE
LAKE ST. JOHN RAILWAY
NORTH-WARD OF
ST. RAYMOND



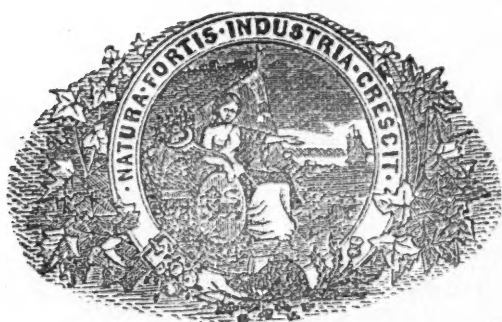
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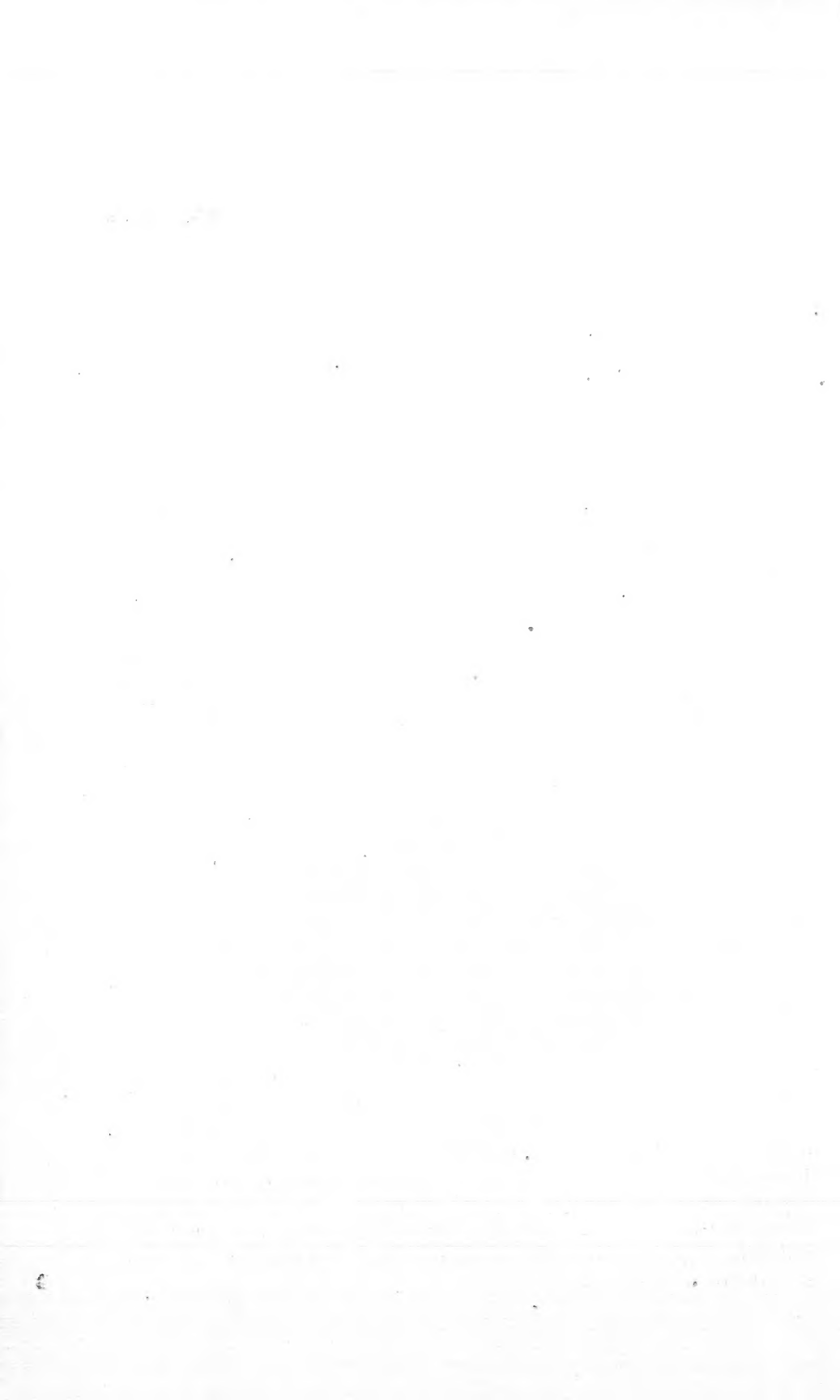
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Quebec, January 25th 1884

*To His Worship the Mayor, The Aldermen and Councillors
of the Corporation.*

Gentlemen,

In compliance with your resolution of the 14th December last, calling on me to report on that portion of the Lake St. John Railway which lies between the left bank of the St. Ann river at St. Raymond and lake Simon, a distance of some 10 miles; I visited the section of road under consideration on the 24th Dec. last, in company with his Worship the Mayor, Mr. Light, Govt. Engineer, Mr Cadman engineer in chief of the road, Mr. Scott the company's secretary, Mr. Cressman the contractor's active and efficient manager and a few other persons interested in the undertaking and in the welfare of Quebec.

A slight fall of snow at the time of my inspection prevented the then examination of some of the minor features of the permanent way, such as the base of the rails, their mode of junction, the fish plates etc, the sleepers which of 6" x 6" in size at the smaller end support, at two feet centres, the steel rails of which the weight is 56 lbs. to the yard.

But I had occasion during two previous visits over this section of road, at a time when nothing prevented a minute inspection of the works, to satisfy myself that the quality of the materials and workmanship leaves nothing to be desired.

The plan of the road, or its birds' eye view as it would be seen if looked down upon from above, indicates the more or less sinuous nature of its location as determined by the necessity of following in such a mountainous section of country, along the course of rivers, lakes and vallies with the view of reducing to a minimum the elevations and inequalities of the ground to be gone over.

On this plan are seen in blue, a color suggestive thereof, rivers, lakes and water courses ; in red, a full red line, that of the fiery steed ; in yellow or burnt sienna, also a suggestive color, the roads or lines of ordinary communication which intersect the railroad at eight different points in this length of section and thereby subserve the purposes of local traffic ; also the several curves, bends or deviations in the road which winding now to the right, now in the opposite direction, make good the junctions between these sinuosities and the straight reaches of the line of way.

These curves are entered on the plan and profile as being of 1° , 2° , 3° etc., which indicates the ratio of their respective radii ; that of 1° (one degree) or less being, easier, flatter, less curved or accentuated than one of 2° or more. The length of curve, its ratio to the whole circumference is put down in degrees and minutes, written in a direction parallel to and near the line of curvature, between the radii, lines dotted in red on plan and which at their apices or points of meeting at the centres of the respective curves, enclose and show the figures indicative as just stated of their greater or lesser curvature necessitated by the nature of the obstacles to be got round.

Other curves are, as forced on the engineer by the exigencies of the route, made up of two, three or more partial curves or bends of varying radii.

The plan is on a scale of 1000 ft. to the inch : more than sufficiently ample to prevent any important detail from escaping attention.

Alluding now to the profile plan which indicates a vertical section of the road, as of the ground it traverses : its side face features, so to say, as if cut through by a vertical plane ; it may be well to remark for the information of such as are not conversant with conventional modes of representation on paper, and who might very naturally at first sight imagine that the section or profile indicates the relative ratios of lengths or distances and heights along the line of way, that such is by no means the case. On the contrary, this would be impracticable as will presently be seen. The scale of profile is 400 ft. to the inch in the direction of its length, its horizontal projection, which for distances of 100 ft. between the station or location pickets, gives one quarter of an inch, a space sufficient for the legible inscription of the successive and respective heights of the surface of the soil above the level of the waters of the St. Lawrence at Quebec, or so to say above sea level. These figures in black written along the base or datum line of the profile, correspond with the line of like color which is the

configuration of the surface as obtained with the levelling instrument by the engineer or surveyor in charge of this preliminary portion of the work.

The next or second series of vertically inscribed figures is that, also above mean tide level at Quebec, of the levels or heights to be given to the road bed, base or formation level, which is to receive the ballasting, sleepers and rails of the permanent way. These figures in red ink refer to and correspond with the line of like color indicating the levels just alluded to.

On the third series above the base or datum line of profile, the vertical figures as seen are alternately blue and red; the indicative of filling, embanking or elevating the soil where the natural surface is depressed or wanting in height; the blue in the same way expressive of the necessity of lowering, excavating, cutting down the surface along the super elevated portions thereof, to reduce them to formation level.

I have just alluded to the impossibility in practice of rendering subservient each to the other the vertical and horizontal scales of the profile or section, and to wit: if in the present case the horizontal scale equalled the vertical, the sheet or drawing would reach to an extent of over 150 ft. in length. If, on the contrary, we would reduce the vertical to the ratio of the other, a thickness of even $\frac{1}{4}$ ft. of cutting or embankment would be reduced to the hundredth part of an inch and thereby rendered altogether inappreciable to the eye. Much the less then would it be possible under such an arrangement to scale off thicknesses of only a foot or an inch in extent.

Now the vertical scale of the present profile is one of 30 feet to an inch or some 13 times greater than the horizontal, and this is why the heights or altitudes exaggerated to a like extent fail to give and cannot give an exact idea of the ratio of their grades or inclinations to the horizon.

I may add to complete one's intelligence of the profile plan in question and which I consider essential here where we are as yet but little familiar with this species of graphic representation of operations performed or to be performed on the ground, dependant on our as yet slight acquaintance with railroads, that the ratio of grades or inclinations to the horizontal, their relative heights and distances are figured on the profile as being of such and such a percentage. This is the simplest manner of indicating them and of facilitating their apprehension. Thus a grade of 1 per cent (1.0 P. C.) indicates one foot in a hundred, that is a rise of one ft. in that distance or 52.8 ft. per mile; 2.0 P. C. therefore indicates double the

grade or 105.6 ft. of rise or fall in a like distance and so on while 0. 1. F. C., 0. 2. P. C. signify respectively, shifting the decimal point one place towards the left, numbers ten times less or only $5\frac{1}{4}$ ft., $10\frac{1}{2}$ ft. rise or fall to the mile respectively.

This question of grades is of the most essential nature on a road of any kind and a fortiori on a railroad where the weight and resistance of a train is of necessity limited to what the locomotive can drag or haul on the steepest inclination throughout the line of way,

Fifty years ago when rail-roads were in their infancy, when locomotive engines weighed but 10 to 20 tons or less, it was indispensable that the railroads be made on nearly a dead level throughout. Hence the enormous cost of european rail-ways averaging as they did £50,000 sterling, or \$250,000 per mile.

If with the engines of days gone by, an attempt had been made to master the steep inclines of our time, the wheels of the locomotive would have simply rotated on their axles, thus slipping or sliding on the rail without imparting any progressive motion to the train of cars.

At the present day on the contrary, we build engines of 80 tons, monsters even of 100 tons weight, the greater portion of which is on the driving wheels and which through the friction such a load produces, causes the wheel to bite the rail in a way to overcome all resistances.

The grades on the section of road now reported are not excessive; the quickest or steepest of them are but 2.2 per cent or $116\frac{1}{2}$ feet to the mile, while on many roads in the United States and elsewhere, these inclinations are greatly exceeded, as I have had occasion to show in one of my former reports on the two first sections of the road now under consideration.

These grades, it will be remarked, are in the ascending direction of the road or from South to North, as would at any rate be evident from a comparison of the successive levels or heights of the respective portions of the road, which at St. Raymond are but 500 ft. above the level of the St. Lawrence, while at lake Simon they attain an altitude of 635 ft; or of 135 ft. above the point of departure at the St. Ann river; while in the opposite direction or returning North to South, the acclivities do not exceed 1.5 per cent, or $19\frac{1}{2}$ feet to the mile; and it is in this direction or city-ward from the lake that the heaviest traffic will always take place or for many years to come, as of grain, wood, stone and other heavy produce and material.

No doubt, these grades could have been reduced, but on the

sole condition of increasing the cost to an extent which would have rendered the road an impossibility with the means at the disposal of the company and have deprived us of it altogether. Nevertheless and let us hope, in the near future, when the requirements of the traffic shall render it essential, the road may be improved by lowering it along the heights and elevating it along or across the hollows or valleys as at St. Raymond where an additional ten feet of elevation over the St. Ann river would reduce by about 500 ft. the length of incline immediately to the North, thus lengthening or extending the level reach beyond the bridge in a way to allow of a more prolonged, a better start, a greater accumulation of velocity wherewith to overcome the rather steep grade of the incline in question.

The same remark applies now more, now less to other acclivities, as to the North-ward of River Rondeau where certain advantages would accrue by raising the level of the bridge some 5 ft. or thereabouts.

Side by side with these minor defects let me evidence the fact that while many engineers and surveyors had sought in vain for a railway to lake St. John, a practicable route through the Laurentians, M. Cadman, the engineer in chief of the road, under the pushing guidance of Mr. Light, has succeeded in making out a way among the mountains of which the summit level is from 500 to 1000 ft. less elevated than heretofore looked for from all the preceding reports on the possibility of a railroad between Quebec and Lake St. John.

I also note with satisfaction that the grades on this section are easier, or of lesser inclination than those on the sections previously reported, and that the locomotives used or to be used on the road will be of a capacity to haul at least 30 cars over the steepest inclines.

On a par with this question of grades, as a retarding factor, influencing the velocity of motion, is that, no less important, of curves of small radius ; but here again we find that Mr. Light, Mr. Cadman have worked wonders with the restrained means at their disposal, turning now West, now East accordingly as the mountain spurs and peaks, so to say piled up in this section of the country, the ravines and hollows forced the engineers to turn an obstacle which the pecuniary means at their disposal did not allow of their getting through by an excavation out of all proportion or a no less expensive tunnel of like extent.

Nevertheless I must note here as in the case of grades on this same section that the curves are less numerous, and of easier

curvature or greater radius than on the first or southern section of the road and Mr. Ridout in his report to the Federal Government states that the grades and curves on the road do not exceed the limits allowable by Order in Council of the 18th August 1883.

But Mr. Mayor and Gentlemen, I must not proceed further without reassuring you: the country traversed is not all mountains. On the contrary, there occurs on this section of the railroad a valley of great extent bearing a close resemblance to that of St. Raymond hemmed in as it is by mountains on all sides; there are fertile lands, habitations of long standing where happiness and abundance are to be found in many a family, fine quarries of magnificent stone, a gneiss or hornblendic granite bearing close affinity to the true rock of the same name: real granite, and which I hope to see at an early period introduced into Quebec and its environs, vast forests which for years to come will supply us with fuel and timber for constructive purposes.

Let us hope also that as elsewhere throughout Canada, mineral riches will not prove deficient.

The grades and curves of which I have spoken, are not of that importance which they acquire between great cities in the old and new worlds. For many years to come, the traffic, essential though it be, or will become between Quebec and the North East will require but a limited number of trains per day. These trains not followed in quick succession by others, as they are at every moment of the day and night between commercial centres, need not be of great velocity and under a less rapid transit, the friction of the wheels upon the rails will be diminished by so much; the danger of derailling at curves reduced to a minimum and the weight of train capable of being moved by the heavy locomotives of the present day: these increased weights or loads I say, under a less rapid rate of transit will to a great extent compensate the advantage of the quicker and less heavy trains of freight which the more pressing and multiple requirements of large centres of commerce render necessary.

Alluding now to the less prominent features of the section of road reported on, a glance at the map or plan and profile will show the position, extent and construction, whether of wood, stone, iron or other material, of the several bridges and culverts as called for by the contract and specifications, or as due to the exigencies of the locality.

Apart from the St. Ann river where a magnificent iron bridge of some 225 ft. span reflecting great credit of the Toron-

to, now the Dominion bridge Co., springs from massive piers or abutments of coursed cut granite masonry laid in hydraulic mortar : the other bridges over the Rondeau, the Jacot etc are of the most solid construction in pine timber of the best quality and heaviest dimensions solidly bound and bolted in iron.

Let me note here again an improvement as compared with the preceding sections of the road : the rails are 6 pounds heavier to the lineal yard, the chairs more solid and secure, the fish plates which join rails or attach them to each other, stronger than of yore, being of angle iron instead of flat, the bridges are better built and more resisting.

The St. Ann Bridge was in my presence during the spring of 1883 subjected to the strain of a heavily loaded train of cars stationed on and converging its entire length and producing a depression or deflection at the centre of only five eighths of an inch.

Mr. Light caused this structure to be made some 30 per cent heavier and stronger than at first intended to allow of running the heaviest trains over it with consolidation engines weighing from 80 to 90 tons, and it is probable that had his advice been followed of similarly increasing the strength of other bridges of a like nature on the road between Montreal and Quebec, we would not have that to deplore the accident which occurred on one of them in the vicinity of the first city a year or two ago. For such structures we can now subserve our own requirements and not as heretofore have to travel out of Canada for the purpose.

The width or breadth of the road at formation level is 15 ft. while on other roads subsidized by the Govt. this width is but 12 and even 9 ft. The cuttings are from 18 to 24 ft. wide at their base according to requirements and in general the rails are elevated above the adjoining soil in a way to free them from accumulations of snow.

The right of way is fenced in on each side with cedar posts and barbed wire rails which while keeping the track clear of animals will more effectually, on a road running North and South, guard against the accumulations of snow which other roads similarly situated and fenced in with wooden rails are subjected to from our prevailing Easterly and Westerly winds.

The ordinary or country roads which cross the line of railway, are everywhere flanked with cattle guards ; every successive farm along the line has its double stile, its gate or passage way, its bridging over the ditch on either side, the same extended to an inclined plain of varying length and height on the mound or dump, according as the height of embankment renders necessary a construction of like nature or the

depth of cutting a correspondingly depressed roadway from one side to the other of each holding.

A line of telegraph is also to be found along the track and beyond the section into that next following, thus completing the requirements of the situation.

The ballasting is as yet incomplete at certain points. This ballasting of the road-bed above formation level generally consists of a foot or two of coarse sand or gravel unmixed with material of an earthy nature. Its effect is to raise the sleepers and rails by so much with the triple view of bringing them to a true level, of disengaging them from snow, and of allowing the percolation of surface water which would otherwise persist in a retentive soil and cause the sleepers to rot the sooner. The ballasting cannot be thoroughly performed at a single operation, nor until due time has been allowed the newly made embankment to settle and consolidate under the combined influences of the successive seasons of a year or two, as well under the compressive effects of heavily laden trains. The same thing may have been observed along the line of railway between this and Montreal and in general the final adjustment of the track to its permanent and intended level can only be arrived at after two and often three or more successive operations spreading over an interval of many months.

On a new road there are also unavoidable wriggles and defects of eccentricity which are rectified at the same time as is the levelling of the rails in the manner often noticed, by raising the rails with their sleepers, shifting the whole in sections to the right or left and thereafter forcing in the ballasting to the complete filling of all voids and interstices.

These defects of levelling & eccentricity on the present section can not be rectified until after another season's consolidation of the road bed under the influences above described, and in the same manner the few points at which the rails cross valleys and ravines on trestle-work, solid and trustworthy though it be, will during the ensuing season be filled in with imperishable materials and the road bed thus made continuous throughout the whole extent of the ten mile section.

MM. Light and Ridout have already, each of them on part of his respective Government, submitted their reports declaring themselves satisfied with the road and that the stipulated conditions have been fulfilled. The Corporation of Quebec cannot be more exigent.

Let us congratulate each other Gentlemen, that this railroad from Quebec to Lake St. John, which has been for so many years a myth, as was also the North Shore Railroad

during a period of some 20 years, is now in a good way of becoming a reality under the active hand of H. J. Beemer Esq., who has signed the contract to complete it within three years. Mr. Beemer has the reputation of pushing his work, doing it well, and of even exceeding the requirements of his contracts when he considers it necessary to do so in the interests of the work.

Let us hope we shall now hear no more of this railroad as of one not destined to go beyond St. Raymond, which was so persistently predicted for a member of years past. Every thing now augurs of the contrary. Mr. Beemer under the vigilant care of his engineer Mr. Hoare aided and abetted by the counsel and experience of Mr. Cressman, his manager and purveyor and of the remainder of his staff, of Mr. Cadman and others, Mr. Scott, the secretary-engineer of the Company, and of Mr. Light the Government engineer, has put up at lake Simon and Northward thereof on the line of location, a host of buildings, a whole little village of them so to say, to house his employes and laboring men, stables for some 30 or more horses, stores already filled with an assortment of tools of every description, forges and shops for the repair of tools and manufacture of machines, a bakery in due form and hard by a store of various goods, where his men without the trouble, delay and expense of a voyage to Quebec can find all that is necessary to subserve their varied requirements, and even a powder magazine has not been forgotten.

Two steam shovels are on the ground capable each of doing the work of some 75 men, steam drills, and some one to two hundred men were at the time of our visit actively engaged in pushing forward on the ten mile section Northward of that which forms the subject matter of this report.

In pursuance of his contract Mr. Beemer has also on the premises some 40 to 50 waggons and other vehicles, 50 platform cars, 18 to 24 dumping cars, ploughs, and two locomotives. Then he has under his contract endowed the Company with a new engine weighing 84,000 lbs. with cylinders of 17 by 24 inches, and its accompanying tender at an additional weight of 50,000 lbs. for active service on the sections now opened to the public.

It may be well also to state here that the company's rolling stock consists of 4 locomotives, 4 passenger cars, a baggage and post-office car, a cattle van, a goods van, 3 closed cars, 55 platform cars, one steam plough of improved construction.

With regard to the proportional cost of this section as com-

pared with those remaining to be done, or of the whole road, Mr. Cadman is of opinion, as witness the report of the Co. transmitted to the Fed. Govt. on the 4th May last (No31316) that the 10 mille section of the road North of St. Raymond is a fair average of the whole line between St. Raymond and Lake St. John, which conveys the impression at the same time, that the grades and curves of the remainder of the line from Lake Simon to the extremity of the road will in no way be inferior to those already alluded to.

May we one and all Gentlemen, in 1886 shake each other by the hand on the borders of Lake St. John; then with a new start push farther and still farther North so that by the end of another decade we may reach the shores of the great lake Mistassini and thence by the valley of the Rupert river, James Bay, at the Southern extremity of Hudson's Bay, thus opening up to our children a vaster field of action, a line of communication shorter, more direct between the fish teeming waters of this vast internal sea of British North America, Canada, the remainder of the continent, Europe and where not; thus also emancipating ourselves at last and once for all from our fealty to that prevailing and dominant idea which has so long, so persistantly held sway over and inthrallled our minds and verry actions in its narrowed though potent grasp: that, failing the lumber trade, there remains nothing for us to devote our energies to in this section of the country.

Let us thank the Federal Govt for what it has already done for the Lake St. John Railway; but let us also remind our rulers at Ottawa that if the Govt. has already expended so many millions in the West: to us the far, far West, the future inheritance of the Province of Ontario; we also, of the Province of Quebec have claims, requirements which can not well be overlooked: that among others of opening up to us a roadway, not into the far but into the nearer East where our children may without straying too widely from their fathers' fire-sides, go seek a livelihood, if nothing more.

The Geographical Society of Quebec, under the presidency of Lt. Col. Rhodes with alderman Chouinard for vice-president, Mr. F. D. Sims of the provincial Treasury as active secretary, abetted by MM. Fletcher, Ledroit and others, with a council of five members of which the undersigned forms part, has already devoted itself to the conquest of that country of fish, furs and minerals. The Colonel's soiree at the St. Louis in presence of an audience composed of the elite of our Citizens is proof of what I advance.

On this occasion several persons following in the wake of

the Col's eloquent speech, and of Mr. Chouinard's lecture, addressed the assembly : amongst others, the Lord Bishop of Quebec, the Hble Mr. Lynch minister of crown Lands, the R. R. MM. Hamel and Laflamme, Mr. Dobell, Mr. Scott and others followed by the Hble Mr. Langelier mayor of Quebec, who reminded us of all the interest he manifests in this section of country, as witness the explorations, which he caused to be made by Mr. Dumais land surveyor as far as 100 miles Northward of Lake St. John while he was a member of the Govt., in his official capacity of minister of Crown Lands, and I am now in a position to inform you Mr. Mayor and gentlemen that the efforts of the Society are about to be crowned with success, and that as early as the end of June next, MM. Bignell and Comeau surveyors and explorers in the company of a squad from the geological commission of Canada, will leave on a two years expedition to survey the Mistassini and explore the country which on the one side divides it from James bay, on the other from the shores of Lake St. John, the commission having to that effect, out of the \$12,000 to be applied to the geological study of Canada, voted \$6,000 or one half of the amount towards the proposed explorations, while the Federal and Local Govts. are to subscribe \$4,000 each towards covering the cost of the expedition.

Let us therefore continue a work so well inaugurated by our determination to push forward at once to Lake St. John, that we may thence penetrate farther into a country all of promise.

I conclude my report on the present section of the Quebec and Lake St. John Railway by recommending that the Corporation, as already done by the Fed, and Local Govts, do perform the needful by the company in paying over to it. the desired instalment as required by the conditions and stipulations attached to the City's subscription in favor of this road of which we will in the near future appreciate all the utility and importance.

CHS. BAILLAIRGÉ, M. A.

Civil & City Engineer

F. R. S. C. etc., etc